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Xanthelasma Palpebrarum: Treatment With the Ultrapulsed CO_2 Laser

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Background and Objective: **Due to its delicate location near the eye and the high recurrence rate, the therapy of xanthelasma palpebrarum is a difficult surgical task. Besides chemical, physical, and surgical procedures, various laser systems have been used to treat these lesions (argon laser, pulsed dye laser, and CO_2 laser). This study was designed to critically evaluate the use of the ultrapulsed CO_2 laser for the treatment of xanthelasma palpebrarum.**
Study Design/Materials and Methods: **We report about the standardized treatment of 23 patients (52 periorbital xanthelasmas) and the results obtained after one treatment with a new generation, ultrapulsed CO_2 laser (COHERENT Ultrapulse 5000C, Palo Alto, CA; 250–500 mJ; 600–900 μsec; 10,600 nm). The follow-up time was 10 months.**
Results: **All lesions could be removed completely with a single laser treatment. As for side effects, only transient pigmental changes (4% hyperpigmentations, 13% hypopigmentations) and no visible scarring was observed. Three patients (13%) developed a recurrence of xanthelasma.**
Conclusions: **The ultrapulsed CO_2 laser is an effective and safe therapeutic alternative to the hitherto described approaches. Lasers Surg. Med. 24:122–127, 1999.** **© 1999 Wiley-Liss, Inc.**

Key words: pulsed dye laser; ultrapulsed CO_2 laser; xanthelasma palpebrarum

INTRODUCTION

Xanthelasma palpebrarum is the most common form of xanthoma. The lesions appear as yellowish, flat, and soft and are located mostly at the medial angle of the eyelid [1]. Although xanthelasma is a benign condition and almost never limits functioning, its appearance is often seen as cosmetically disturbing. Surgical excision has been the treatment of choice for decades. However, this normally effective measure bears a considerable risk of side effects, especially an ectropion, which could lead to additional procedures, e.g., full thickness skin graft [2–6]. Recently, several case reports have described the successful treatment of xanthelasma with the carbon dioxide laser, mostly in the continuous mode [7–12]. The uncontrollable penetration depth of the laser beam in the continuous mode explains the high risk of scarring and posttherapeutic pigmentary changes. This has lead to the development of superpulsed and ultrapulsed CO_2 lasers, which deliver the energy in a defined laser flash.

Between November 1996 and June 1997, we treated 23 patients (i.e., 52 xanthelasmas) with an ultrapulsed CO_2 laser (Coherent 5000C; Palo Alto, CA). This device delivers high energy beams (500 mJ) in very short impulses (600–900 μsec) and thus allows the controlled and safe ablation of very thin skin layers.

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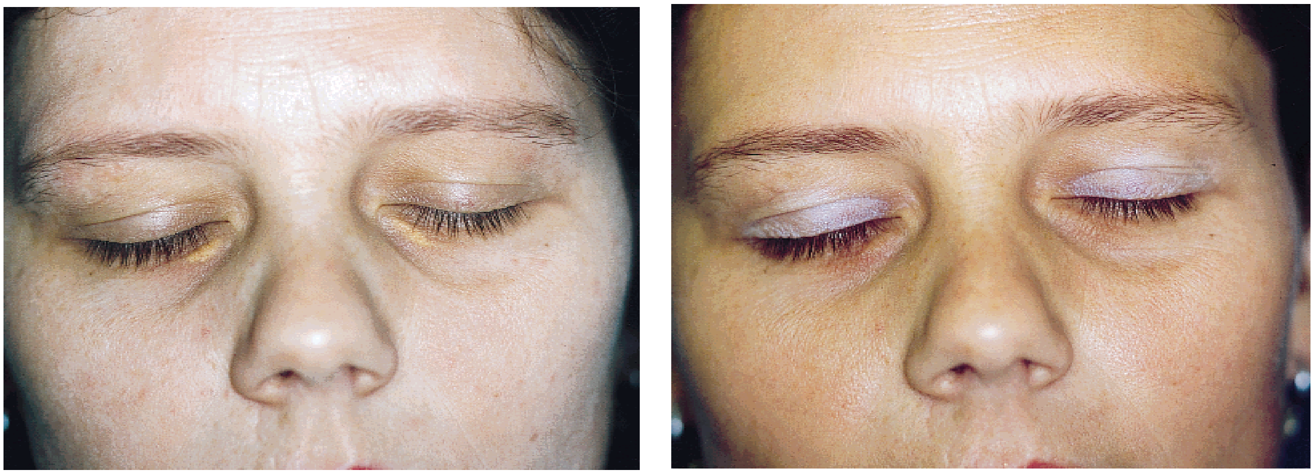


Fig. 1. **(a)** A 34-year-old female patient with xanthelasmas of the lower eyelids (March 1997). **(b)** Same patient, 7 months after a single laser treatment with the ultrapulsed CO_2 laser. The lesions are completely gone, no pigmental or structural changes of the treated area can be seen.

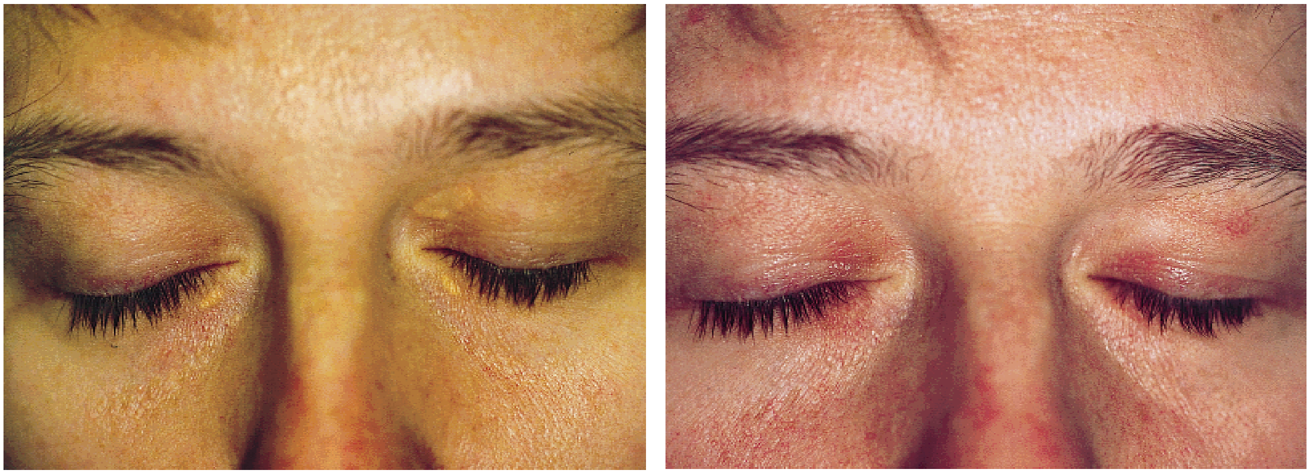
MATERIALS AND METHODS

Between November 1996 and June 1997, we treated 23 patients (16 female, 7 male; aged between 32 and 70 yrs; average: 45 yrs) with 52 xanthelasmas (35 upper lid, 17 lower lid). Six patients had been treated before, 1 with surgical excision, 5 with dye laser therapy. Twenty-two of the lesions were larger than 1.0 cm^2, 30 lesions were <1.0 cm^2. 6 patients had extensive xanthelasmas (at least two xanthelasmas, both measuring >1 cm). Snap test was performed in all patients. For all lesions, we used an ultrapulsed CO_2 laser (Coherent 5000C; 10,600 nm wavelength; maximal pulse energy 500 mJ/impulse; impulse duration 600–900 μsec). A continuously adjustable variable spot-size handpiece (spot diameter 1.5–2.5 mm) was used. The applied energy ranged between 250 and 500 mJ. The 500 mJ impulses were used to remove the actual xanthelasma tissue. To level off the abladed area to the surrounding tissue, 250 mJ impulses were applied. The patients were advised to keep their eyes closed during the entire procedure. For extra protection, the untreated eye was covered with a light impermeable gauze pad and the eyelid of the treated side was held down by an assistant. In the meantime we have been using nonreflective corneal shields for more complete eye protection. Before lasering, the lesions were infiltrated with local anesthetics (1% lidocaine-hydrochloride). Between laser applications, the evaporated skin layers were removed with a moist cellulose pad. Between 4–7 passes were made for the macroscopic removal of the lesions. To soothe the typical post-therapeutic erosions, ophthalmic vaseline was applied for 1 day together with anti-inflammatory, cold black tea compresses. This immediate postoperative treatment was followed by topical antibiotic ointment for another 6–9 days. The patients were advised to not to touch at the delicate crusts and to avoid sun exposure and tanning booths for at least 6–8 weeks. The follow-up period was 10 months.

Sixteen out of 23 patients were tested for pathologic serum lipids (total cholesterol, HDL-cholesterol, LDL-cholesterol, triglycerides, lipoprotein a; Prof. Seelig's laboratory Karlsruhe, Germany; normal values: total cholesterol: 140–220 mg/dl; HDL-cholesterol: >55 mg/dl; LDL-cholesterol: <150 mg/dl; triglycerides: <150 mg/dl; lipoprotein a: <30 mg/dl). A combined increase of triglycerides and total cholesterol with normal lipoprotein values were considered as mixed hyperlipidemia. Pathological lipoprotein levels were classified in the Fredrickson scheme. Pathological lipid values were controlled and patients were counseled for dietary adjustments or drug treatment. Furthermore, a cardiology checkup was recommended. Photos were taken with a Canon EOS100, using Agfa CTx100 films.

RESULTS

All 52 xanthelasmas were removed completely with a single ultrapulsed CO_2 laser treatment (Figs. 1a and 4b). There were no differences in treatment results with regard to the localization of the lesions (upper or lower lid). Three pa-



a b

Fig. 2. **(a)** A 36-year-old female patient with xanthelasma palpebrarum of both lower eyelids and of the left upper lid (May 1997). **(b)** Same patient, 13 months after a single laser treatment. All lesions are completely removed (August 1998).

a b

Fig. 3. **(a)** A 56-year-old female patient with xanthelasmas of both upper lids (August 1996). Eight pulsed dye laser treatments have left no effect on the lesions. **(b)** Same patient, 10 months after a single treatment with the ultrapulsed carbondioxide laser. Hypopigmentations can be detected in both treatment areas.

tients showed slight erythema of the treated area persisting for 2 months; two patients showed erythema for 4 months. There was no posttherapeutic hyperpigmentation except for one patient, which lasted for ~7 months. A total of 13% of the patients (3 out of 23) showed transient hypopigmentation of the treated area (Figs. 2a, b, 3a, b). Three patients developed a recurrence of xanthelasma within a mean follow-up time of 10 months. One of them had excessive manifestation at both eyelids (9 xanthelasmas) and showed recurrence at four distinct areas within 5 months after the laser treatment (Figs. 4a, b). This patient has been treated five times before with surgical excision and two full thickness skin grafts. We retreated the recurrent lesions with the ultrapulsed CO_2 laser. Recently no case of ectropion occurred.

All patients were very satisfied with the laser treatment. The laser application itself and the postoperative phase were considered as only slightly irritating and stressful. We did not see any other complications, e.g., hematomas, bleedings, infections, facial assymetries, or ectropions. Two of 16 (12%) tested patients were diagnosed with mixed hyperlipidemia, 6 of 16 (37%) with hypercholesteremia type IIa. Eleven patients (69%) had low HDL-values, 4 (25%) had high lipoprotein a values.

No correlation was found between xanthelas-

a b

Fig. 4. **(a)** A 56-year-old male patient with excessive xanthelasma palpebrarum of the left eye (March 1997). The patient had undergone five surgical excisions and two full skin graft transplantations previously. **(b)** Same patient, 5 months after a single CO_2 laser treatment (August 1997).

TABLE 1. Correlation of Xanthelasma, Extensive Xanthelasma, and Recurrence of Xanthelasma to Serum Lipids

	No. of patients	Serum lipids		
		Normal	Abnormal	Unknown
Xanthelasma	23 (100%)	8 (34.8%)	8 (34.8%)	7 (30.4%)
Extensive xanthelasma	6 (26.0%)	3 (13.0%)	1 (4.3%)	2 (8.7%)
Recurrence	3 (13%)	2 (8.7%)	1 (4.3%)	–

mas, extensive xanthelasmas, recurrence of xanthelasmas, and serum lipids (Table 1).

DISCUSSION

The carbon dioxide laser is the most widely used laser system in surgical dermatology. The CO_2 laser beam (10,600 nm wavelength) is selectively absorbed by the extracellular fluid of biologic structures. This leads to an unspecific vaporisation and photocoagulation of the tissue. In contrast to other systems, e.g., ruby laser or pulsed dye laser, pigmentation or the amount of vascularization of the target tissue does not play a critical role in the laser effect. The mode of action of the carbon dioxide laser allows a layer-by-layer ablation of thin skin strata. Therefore, this device has proven itself safe and effective for the removal of various superficial, benign skin lesions, e.g., verrucae, seborrhoic keratosis, actinic cheilitis, syringomas, as well as facial wrinkles and acne scars [8,11,13–16].

The ultrapulsed CO_2 laser belongs to a new generation of carbon dioxide lasers. It emits extremely short light pulses (600–900 μsec) with high peak energies (up to 500 mJ). As the pulse duration lies well beyond the thermal relaxation time of skin, thermal damage to the surrounding tissue is avoided. Fitzpatrick et al. have shown that by a single ultrapulsed CO_2 laser treatment of 250 mJ impulses, the skin is ablated to a depth of up to 60 μm. A second consecutive laser application increases the depth of the damage to ~130 μm; a third leads to thermal destruction of skin structures to a depth of up to 316 μm [17]. This careful study shows that the ultrapulsed carbon dioxide laser allows a very precise ablation of skin layers. This gentle and superficial effect avoids damage to delicate deeper structures, thereby preventing the occurrence of posttherapeutic scarring and lasting pigmentary changes.

Several publications have described the effective application of the CO_2 laser in the continuous or in the superpulse mode for the ablation of xanthelasma palpebrarum [8–12]. Only one case report has been published that demonstrates the efficacy of the ultrapulsed CO_2 laser (7). Our present study is the first to describe the treatment of xanthelasmas with this device in a larger patient group and to discuss possible side effects.

The “classical” treatment option for xanthelasma palpebrarum is the surgical excision. [2–6].

Alternatives to this treatment is cauterization with trichloracetic acid, liquid nitrogen, or organic and nonorganic acids [18,19]. However, all of these methods bear considerable risks of side effects. Surgical excision always leads to scars, which might, in turn, cause an ectropion. Furthermore, the revision of the scar can require a skin graft procedure. Very extensive lesions may not be operable at all. Furthermore, for the treatment of relapses, the surgical approach may not be repeatable. The therapeutic effect of chemical measures is often unsatisfactory. The depth of tissue penetration by the chemicals is hardly controllable; the risk of damage to the conjunctivae or the sclerae is high.

Some groups, including ours, reported about the treatment of xanthelasmas with the pulsed dye laser or the argon laser [20–23]. The efficacy of these devices, however, is limited by their rather short penetration depths, requiring at least 4–8 treatment sessions and bearing a considerably higher recurrence rate. Therefore, we recommend the use of the pulsed dye laser only for the therapy of initial, flat xanthelasmas. Five out of 23 patients in the present study had been treated up to 11 times with the pulsed dye laser before. On the basis of the recurrent and refractory behavior of these lesions, we decided to treat the patients with the carbon dioxide laser instead. Treatment of xanthelasma palpebrarum with the argon laser seems to lead to significant recurrence rates as well. Hintschich reports 12 relapses out of 32 treated lesions within the first 12–16 months after argon laser therapy [22]. In another study, however, no recurrences of 21 treated xanthelasmas were observed within a follow-up period of 1 year [20].

The relatively high recurrence rate seems to be a typical characteristic of xanthelasma palpebrarum. In a study from Mendelson and Masson [5], 40% of surgically excised lesions relapsed, and as much as 60% of the repeatedly treated xanthelasmas recurred again. In most of the hitherto published reports on the treatment of xanthelasma palpebrarum, the study group is relatively small, so that the reported rates of side effects and relapses should be viewed with some caution [7–12]. The side effect that has been documented most often is postoperative hypopigmentation. In a study with 22 patients who had been treated with the carbon dioxide laser in the continuous mode, four patients showed hypopigmentations, one patient had hyperpigmentation of the treated area, and two patients experienced a recurrence of the lesions [12]. In another study, a relapse was observed in two out of nine patients [10]. These studies are comparable to our results. One of our patients (4%) showed hyperpigmentation, whereas three patients (13%) showed hypopigmentation after the laser treatment. Three patients (13%) experienced a recurrence within 10 months of observation. Three patients showed slight erythemae, which lasted 2–4 months. Visible scarring was not observed at all.

Histologically, xanthelasma palpebrarum shows numerous lipid-storing histiocytes (“foam cells”) in the upper corium [1,24]. Due to their superficial location, xanthelasmas are an ideal target for the ultrapulsed CO_2 laser. The precise, layerwise photoablation and -coagulation of the skin’s strata allows a gentle and bloodless, yet radical ablation of the lesions. Macroscopically, a sudden change of color and texture shows that the bottom of the xanthelasma has been reached. The remaining laser-induced erosion is reepithelialized from the margins and from dermal basal cells.

Approximately 50% of xanthelasma patients suffer from disorders of lipid metabolism [1,24,25]. In our group, 2 out of 16 tested patients showed a mixed hyperlipidemia and 6 patients were diagnosed with hypercholesterolemia (Fredrickson type IIa). If the appearance of xanthelasmas is combined with disorders of lipid metabolism, the risk of atherosclerotic diseases may increase, especially if additional lipoprotein- and apolipoprotein-levels are high [24–27]. Other derangements of serum lipid levels also have been found, but these results are somewhat contradictory and need further clarification, e.g., low HDL-cholesterol [24–26]. In our study no correlation was found between xanthelasmas, extensive xanthelasmas, recurrence of xanthelasmas and serum lipids (Table 1). It has been hypothesized that the formation of xanthelasmas begins with the storage of excessive plasma lipids by histiocytes, which are located in close proximity to blood vessels [1,24]. The exact pathophysiological mechanism, however, has not yet been fully understood.

In case of recurrence, we recommend a further treatment with the ultrapulsed CO_2 laser or the pulsed dye laser. However, it is crucial that the xanthelasmas are treated in their early stages of development. The reason of recurrence in our study may be due to overly superficial ablation, although deeper surgical treatment is no guarantee of permanent removal.

In conclusion, the ultrapulsed CO_2 laser is a clever therapeutic option for the treatment of xanthelasma palpebrarum. It is advisable to treat as soon as diagnosed. The advantages of this method are the accurately controlled ablation of thin skin layers, the option for a repeated application in case of recurrences, the unproblematic and safe treatment in delicate regions of the periorbital area, and the low risk of visible scarring, as well as the low recurrence rate. CO_2 laser treatment is principally an out-patient and fast procedure. Patients seem to tolerate the treatment well. On the basis of our results, we would like to recommend xanthelasma treatment with the ultrapulsed carbon dioxide laser as an excellent therapeutic alternative to the hitherto described approaches.

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